

sequelae not supported by scientific study. If not, we may unintentionally mislead our patients by diverting attention away from truly harmful life-style traits. Imagine a patient with coronary artery disease experiencing a sense of accomplishment after restricting coffee use while continuing to smoke and to enjoy high-fat food.

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## Urinary Tract Infections—Navigating Complex Currents

*Row, brothers, row! the stream runs fast,  
The rapids are near, and the daylight's past!*

THOMAS MOORE, 1806

SIMPLY DEFINED, urinary tract infection (UTI) refers to the presence of a substantial number of bacteria in the urine.<sup>1</sup> The goals of treatment and management also are simple: to relieve acute symptoms, to avert irreversible damage to structures of the urinary tract, and to prevent recurrent infections.<sup>2</sup> Such apparent simplicity, however, belies the complexity of decisions that await a clinician who suspects this disease in an infant or child.

Much of the complexity is inherent in pediatric patients in whom symptoms are often nonspecific and variable, the collection of an uncontaminated urine specimen is frequently problematic, guidelines for treatment vary with age, and the risk of permanent damage to the developing renal system presents a serious concern. Infections of the urinary tract during childhood are second in prevalence only to infections of the respiratory tract. Fortunately, the consequences of UTI during infancy and childhood are usually benign; nevertheless, serious sequelae can occur when underlying abnormalities are not detected and appropriately managed.

In this issue of the journal, Zelikovic and colleagues provide a thorough review of the many facets of UTI in children.<sup>3</sup> The scope of this update reflects the complexity of the problem. Although the decision process confronting a practitioner may seem daunting, a clear understanding of the goals and guiding principles of management helps to simplify the process and avoid pitfalls that complicate diagnosis and management. We highlight selective points here.

- Consider UTI in the evaluation of any febrile infant or child. In a recent prospective study of 442 febrile infants younger than 8 weeks, 33 (7.5%) had UTIs. Of these 33 infants, urinalysis was recorded for 32; only 16 of these urinalyses were suggestive of a UTI based on the presence of

bacteria or greater than 5 leukocytes per high-power field.<sup>4</sup> Thus, more than half of the UTIs in this population would have been undetected if the decision to obtain a urine culture were based on abnormal results of a urinalysis.

Although many ancillary tests are available and helpful, their predictive value is poorly defined. Urine culture therefore remains the gold standard for diagnosis. Nevertheless, do not underestimate the ease and value of in-office examination of an unspun, unstained urine specimen under 40-power microscopic lens. If bacteria and leukocytes are observed, the presumptive diagnosis is made.<sup>2</sup>

- Insist on proper specimen collection. This means urethral catheterization or suprapubic aspiration in infants and clean, midstream "catch" in older patients who are able to cooperate. A "bagged" urine specimen, the microbiologic equivalent of a heel-stick specimen for blood culture, is useful only when there are no abnormalities. Remember that the result of such a culture will not be known until after empiric therapy has begun; thus, the interpretation of a subsequent confirmatory culture will be complicated.

- Applying the strict definition of UTI based on the number of colony-forming units (CFU) of bacteria isolated per milliliter of urine must be coupled with common-sense clinical judgment. Bacterial counts can be lower in a patient who is excessively hydrated, who has had antimicrobial therapy, and who has been voiding frequently. Furthermore, the widely accepted standard definition of 10<sup>5</sup> or more CFU of bacteria per milliliter of urine is based on studies done in the 1950s of adult women.<sup>5</sup> In a remarkable study reported in 1982, 187 women with acute dysuria underwent suprapubic aspiration or urethral catheterization from which the specimen was cultured and the results compared with those of a midstream urine specimen; 47 of 98 women (49%) whose bladder urine contained coliforms had midstream urine coliform counts of less than 10<sup>5</sup> CFU per ml, and 30% had less than 10<sup>4</sup> CFU per ml.<sup>6</sup>

- Treatment recommendations differ depending on the infecting organism, the locus of infection, and the patient's age. The guidelines discussed by Zelikovic and co-workers are appropriate and widely accepted.<sup>3</sup> Discussion and controversy regarding the issue of short-course therapy for UTI in children are certain to continue. Although studies have demonstrated that bacteriologic cure rates are similar for single-dose and multidose regimens in the treatment of acute uncomplicated UTI, some have shown that the recurrence rate after single-dose treatment is higher compared with conventional regimens. For example, in a study that evaluated the efficacy of three treatment regimens using a combination of trimethoprim and sulfamethoxazole (1 dose, 3 days, and 7 days) for children with acute uncomplicated UTI, 20.5% of those given one-dose treatment had recurrent UTI compared with 5.6% and 8% of those given three days and seven days of treatment, respectively.<sup>7</sup>

- Appropriate imaging studies of the urinary tract should be done after the first episode of UTI in girls younger than 5 years and in boys of any age, in older girls (not sexually active) with recurrent UTI, and in any child with pyelonephritis. The goal is to detect structural and functional abnormalities that may predispose the child to the development of renal scarring and its serious sequelae, including arterial hypertension and renal insufficiency. In recent years there have been substantial gains in the quality and quantity of imaging studies. Especially notable are the proliferation of

radionuclide studies and improvements in ultrasonographic equipment and operator skills.

We agree with Zelickovic and associates that the choice of examinations depends on the facilities available, the skills and experience of the radiologist, and the clinical findings.<sup>3</sup> We also agree that the optimum initial imaging evaluation after a child's first UTI should include ultrasonographic evaluation of the kidneys (to detect scarring, abscess, or malformation) and voiding cystourethrography (to detect reflux and, in boys, anatomic abnormalities of the urethra). When appropriate radiologic facilities and expertise are available, however, note that some prefer ultrasonography and radionuclide voiding cystography as the initial studies for girls. Although radionuclide voiding cystography permits neither anatomic evaluation of the urethra nor the grading of reflux, it will detect reflux if present. An important feature is that with radionuclide cystography, the ovaries undergo exposure to only about 1/100th of the ionizing radiation of the conventional fluoroscopic voiding cystourethrogram.<sup>8</sup> If this radionuclide study is abnormal, further evaluation may then be indicated. Evaluation by a specialist should be strongly considered for any patient with moderate to severe reflux or notable findings of renal abnormalities.

The timing of imaging studies after the diagnosis of UTI has been the subject of considerable discussion. For a patient who has responded appropriately to treatment, some argue that several weeks should elapse before the voiding cystourethrography study because the inflammation caused by the acute infection may itself cause reflux. Others counter that the documentation of reflux, regardless of the cause, is the important goal. Although a delay may be ideal, the reality is that imaging a "captive" inpatient often provides the best assurance that the study will be completed. In any case, if imaging studies are delayed, many recommend continuing low-dose prophylactic antimicrobial treatment in the interim; this will prevent recurrent infection and avert possible renal damage until the urinary tract anatomy is defined.<sup>2,9</sup>

- The goal of the management of children with mild to moderate vesicoureteral reflux is the prevention of recurrent UTI while growth proceeds. Mild to moderate reflux usually resolves spontaneously with growth. We agree that repeated ultrasonographic evaluation every one to two years is indicated to follow renal growth and that radionuclide cystograms should be used to determine the resolution of reflux so that antimicrobial prophylaxis can be discontinued when appropriate.

In conclusion, infections of the urinary tract during childhood are a common occurrence requiring careful and thoughtful management by clinicians. In a recent symposium that addressed the clinical challenges posed by this diagnosis, Oski lamented that "no matter what progress we make in the area of urinary tract disease, the question of what to do with a presumed UTI is still a puzzler for the general pediatrician."<sup>10</sup> The thorough and lucid update of this topic by Zelickovic and colleagues is recommended reading for those who wish to be puzzled less and enlightened more.<sup>3</sup>

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## Osmotic Shifts, Metabolic Compromise, and the Vulnerability of the Pons

IN 1959, ADAMS, VICTOR, AND MANCALL published their landmark article on central pontine myelinolysis, a disease primarily affecting myelinated nerve fibers in the center of the basis pontis and associated clinically with flaccid quadriplegia and bulbar paresis.<sup>1</sup> In the original report, all four patients had chronic malnutrition of alcoholism. Hundreds of cases have since been reported, broadening the clinical spectrum to include liver and renal transplantation, severe burns, systemic and central nervous system malignancy, hyperalimentation, severe bacterial infections, acute hemorrhagic pancreatitis, and pellagra. A noteworthy feature remains: central pontine myelinolysis primarily affects patients afflicted with long-standing, severely debilitating disease rather than those with acute illness, and common to many of the chronic illnesses is severe hepatic dysfunction or nutritional deficiency.

The earliest clinical manifestation of the disorder is clouding of the mental state, ranging from obtundation and disorientation to coma. These changes most commonly reflect a generalized metabolic encephalopathy, as the clinical situation is often grave and there may be marked disturbances of electrolytes. Classically, over the next few days, complete flaccid paralysis develops of all four limbs, and the patient has severe weakness of the face and palate and an inability to chew, speak, or swallow. Bilateral corticospinal tract signs with spasticity and extensor plantar responses emerge several days later. In this state, associated with large midline lesions of the pons, the patient may be alert and relatively coherent but incapable of any response save for eye blinks and movements, a condition referred to as the "locked-in" syndrome. With more restricted lesions, other clinical manifestations including cerebellar ataxia and cranial nerve palsies may develop due to involvement of the cerebellar peduncles and cranial nerve nuclei. Extreme emotional lability, or spasmotic laughing or crying, may be seen. Behavioral abnormalities, often obscured by other clinical deficits, include restlessness, inattentiveness, agitation, and confusion. Clinically silent lesions are frequent, as the majority of lesions are small and affect only a few millimeters of the midline pontine raphe, corticopontine, or pontocerebellar fibers.

Early investigators regarded this disorder as invariably fatal, but the development of computed tomographic (CT)